The Potential Use of Population Modelling to Discriminate between Alternative Stock Structure Hypotheses

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In principle, the data available for stock assessment purposes can be analysed by fitting models that assume (say) either one or two stocks, with the preferred of the two assumptions being determined by standard model selection procedures.

For example, two sets of data compatible with an assumption of two stocks may become inconsistent if only one stock is assumed, thus eliminating the latter possibility. Even if both assumptions lead to compatibility, the value of a model selection criterion such as AIC (Akaike's Information Criterion) can be used for discrimination.

For a more specific example, assume that each of the *M. paradoxus* and *M. capensis* populations off the South African west coast and Namibia comprised single homogeneous (fully mixed) stocks. Each would then be expected to show identical trends with time. The Figure below shows log-linear regressions plotted through the results for time-comparable (i.e. same vessel used) abundance estimates from research surveys.

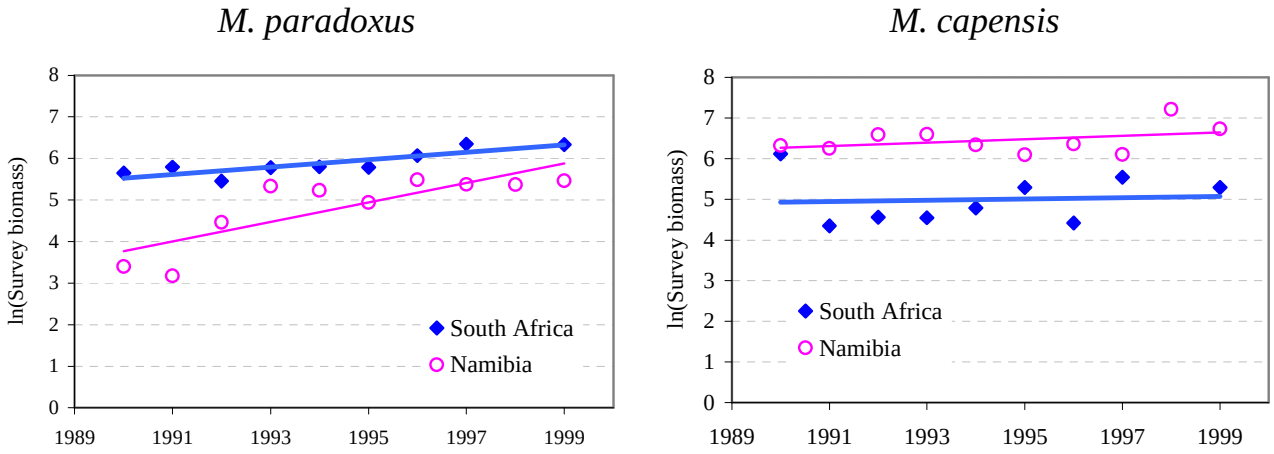

Fig. 1: Log-linear regressions through survey biomass estimates for *M. paradoxus* and *M. capensis* for the South African west coast and Namibian summer surveys. Annual percentage increases with standard errors in parenthesis are:

M. paradoxus : South Africa: 8.9% (2.0%)
Namibia: 23.5% (5.8%)
M. capensis : South Africa: 1.5% (7.8%)
Namibia: 4.2% (3.6%)

The two *M. capensis* trends are quite compatible, but for *M. paradoxus*, the trends are on the verge of significant difference (i.e. inconsistency) at the 5% level. Hence, considering these data alone, one could argue that the hypothesis of a single homogeneous stock is not tenable for *M. paradoxus*.

Naturally this illustration does not constitute a definitive evaluation of the question of whether either of these populations comprise single stocks. For example, it could be that the *M. paradoxus* plot reflects a single stock which is not homogeneously distributed, with a greater relative expansion in the abundance of its northern component as the whole stock recovered. More complex assessment models could take account of that possibility.

In an actual "stock structure discrimination" exercise of this nature, all the data available for the assessment would be considered, with evidence of model mis-specification or model selection criteria statistics used in comparing results for scenarios assuming differing numbers of stocks or different distributions for multiple stocks. This process then allows for the elimination of hypotheses that are either inconsistent with, or comparatively highly unlikely given, the available data.